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**Constellation
Nuclear**

**Calvert Cliffs
Nuclear Power Plant**

*A Member of the
Constellation Energy Group*

October 5, 2000

U.S. Nuclear Regulatory Commission
Washington, DC 20555

ATTENTION: Document Control Desk

SUBJECT: Calvert Cliffs Nuclear Power Plant
Unit No. 1; Docket No. 50-317; License No. DPR 53
Licensee Event Report 2000-005
Reactor Trip Due to Spurious Main Steam Isolation Valves Closing

The attached report is being sent to you as required under 10 CFR 50.73 guidelines. Should you have questions regarding this report, we will be pleased to discuss them with you.

Very truly yours,

PEK/JKK/bjd

Attachment

cc: R. S. Fleishman, Esquire
J. E. Silberg, Esquire
Director, Project Directorate I-1, NRC
A. W. Dromerick, NRC

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Resident Inspector, NRC
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IE22

LICENSEE EVENT REPORT (LER)

(See reverse for required number of
digits/characters for each block)

Estimated burden per response to comply with this mandatory information collection request: 50 hrs. Reported lessons learned are incorporated into the licensing process and fed back to industry. Forward comments regarding burden estimate to the Records Management Branch (T-6 F33), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, and to the Paperwork Reduction Project (3150-0104), Office of Management and Budget, Washington, DC 20503. If an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

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Calvert Cliffs Nuclear Power Plant, Unit 1

DOCKET NUMBER (2)

050000 317

PAGE (3)

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TITLE (4)

Reactor Trip Due to Spurious Main Steam Isolation Valves Closing

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
09	10	2000	2000	005	00	10	05	2000		050000
									FACILITY NAME	DOCKET NUMBER
										050000

OPERATING MODE (9)	1	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)						
POWER LEVEL (10)	100	20.2201(b)		20.2203(a)(2)(v)		50.73(a)(2)(i)		50.73(a)(2)(viii)
		20.2203(a)(1)		20.2203(a)(3)(i)		50.73(a)(2)(ii)		50.73(a)(2)(ix)
		20.2203(a)(2)(i)		20.2203(a)(3)(ii)		50.73(a)(2)(iii)		73.71
		20.2203(a)(2)(ii)		20.2203(a)(4)	X	50.73(a)(2)(iv)		OTHER
		20.2203(a)(2)(iii)		50.36(c)(1)		50.73(a)(2)(v)		Specify in Abstract below
		20.2203(a)(2)(iv)		50.36(c)(2)		50.73(a)(2)(vii)		or in NRC Form 366A

LICENSEE CONTACT FOR THIS LER (12)

NAME

J. K. Kirkwood

TELEPHONE NUMBER (Include Area Code)

410-495-2013

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX
B	JE	IMOD	6506	Y					

SUPPLEMENTAL REPORT EXPECTED (14)

YES (If yes, complete EXPECTED SUBMISSION DATE).	X	NO	EXPECTED SUBMISSION DATE (16)	MONTH	DAY	YEAR
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ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)

At 2123 on September 10, 2000, Calvert Cliffs Unit 1 tripped from 100 percent power due to a spurious signal from Channel A of the Engineered Safety Features Actuation System Steam Generator Isolation Signal. A logic module in the Steam Generator Isolation Signal produced a spurious signal that closed the Main Steam Isolation Valves. The closed Main Steam Isolation Valves created shrink in both steam generators and the Unit 1 reactor tripped on low steam generator water level.

Operators responded appropriately and primary plant systems functioned as designed. The plant was brought to a safe shutdown condition.

The suspect Channel A Steam Generator Isolation Signal logic module was replaced and the new module was post-maintenance tested satisfactorily. The suspect logic module was sent to the vendor for testing and destructive analysis. The unit was restarted September 12, 2000. A detailed root cause analysis is in progress to determine causal factors, generic implications, and establish additional corrective actions, as required.

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TEXT (If more space is required, use additional copies of NRC Form 366A) (17)

I. DESCRIPTION OF EVENT

On September 10, 2000 at 2123, during normal steady-state operations in Mode 1, Calvert Cliffs Unit 1 tripped from 100 percent power due to a spurious signal from the Channel A Steam Generator Isolation Signal (SGIS) portion of the Engineered Safety Features Actuation System (ESFAS). The spurious SGIS closed the Main Steam Isolation Valves (MSIV) for both 11 and 12 Steam Generators (1-CV-4043 and 1-CV-4048, respectively).

The closed MSIVs, and accompanying rapid halt in steam flow from the steam generators caused shrink (a lowering water level) in the steam generators. The Reactor Protective System (RPS) tripped the Unit 1 Reactor when steam generator water level reached the low steam generator water level trip setpoint of minus 50 inches.

Control Room Operators started the No. 13 Auxiliary Feedwater Pump manually to feed steam generators. The Auxiliary Feedwater Actuation System started the No. 11 Auxiliary Feedwater Pump when steam generator water level reached the Auxiliary Feedwater Actuation System setpoint of minus 170 inches.

The main steam safety valves cycled open and shut due to the rapid steam generator pressure increase caused by MSIV closing. Operators used the atmospheric dump valves to control reactor coolant temperature due to the loss of normal heat removal caused by the closed MSIVs.

After the trip, No. 11 Moisture Separator/Reheater second-stage steam source isolation valve (1-MS-4025) did not close. Plant operators reset the circuit breaker supplying power to the motor operator for the valve, and closed 1-MS-4025, within minutes of identifying the valve open.

The MSIVs were opened and Reactor Coolant System temperature control using turbine bypass valves was resumed by 0430 September 11, 2000.

II. CAUSE OF EVENT

The Unit 1 Reactor trip was caused by a spurious signal from Channel A logic module in the SGIS portion of the ESFAS. The suspected module was sent to the vendor for testing. The vendor suspects the spurious signal was caused by a fault in the module, possibly caused by corrosion internal to an integrated circuit chip mounted in the module. A testing lab contracted by the vendor who supplied the ESFAS module will conduct further destructive testing of the suspected integrated circuit.

The spurious SGIS closed the MSIVs of both Unit 1 steam generators. The rapid reduction of steam flow created shrink in the steam generators that lowered the water level beyond the low steam generator water level trip setpoint of the RPS. The reactor and main turbine tripped as designed.

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Post-trip troubleshooting found the insulation of a wire in the motor-operator of 1 MS-4025 was degraded due to chafing caused by vibration of the steam line in which the valve is mounted.

III. ANALYSIS OF EVENT

The inadvertent closing of the MSIVs is not an accident initiator for Calvert Cliffs Nuclear Power Plant. The SGIS exists to rapidly isolate steam generators in the event of a main steam line break. Spurious activation of the SGIS will not initiate an accident. There was no undue risk to the health and safety of any member of the general public, or risk of exposure to ionizing radiation to any individual from this event. Protective relays and circuit breakers operated as designed, and the unit was brought to a safe shutdown condition without further incident. Operators responded appropriately, and primary plant systems functioned as designed to stabilize the plant.

The closed MSIVs resulted in a loss of the normal heat sink and was a distraction to the Control Room Operators responding to the trip, but did not present a safety hazard during the event.

The failure of 1-MS-4025 to close could cause a loss of normal heat removal, but the loss had already occurred due to the MSIVs closing. The ability of the plant operators to reset the breaker for 1-MS-4025, and close the valve, would have prevented the loss of normal heat removal had the trip itself not resulted in the loss of normal heat removal.

Significance Determination

The spurious signal from the SGIS ESFAS module is being evaluated to determine if it was an indication of a systematic problem with the overall ESFAS system. The initial determination is that it is not an indication of a systematic problem, and is a random failure. A review of plant history found no cases of similar ESFAS failures. Based on the lack of any trend of increased failure rates for this mode of failure (spurious actuation), and the system manager's initial evaluation, this appears to be a random failure. Therefore, the current initiating event frequencies for events related to spurious actuation of ESFAS modules are believed to remain applicable. This failure did result in the loss of normal heat removal, thereby reducing the plant's heat removal mitigation ability. This event had a conditional core damage probability of $6.0E-6$. Although the ESFAS failure is not believed to cause a measurable core damage frequency increase, it is recognized that this trip is one of several events challenging the initiating event cornerstone, specifically, the indicator for loss of normal reactor cooling system following reactor shutdown. The challenge to this indicator is currently being addressed through the plant's corrective action program.

The potential for 1-MS-4025 to fail to close during 102 days of plant operation could cause a loss of normal heat removal following a plant trip. Failure to isolate 1-MS-4025 would result in the MSIVs being manually closed

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at 800 pounds per square inch-absolute in the steam generators. Although the breaker for 1-MS-4025 did reset on this occasion, the failure mode makes it quite probable that it could not reset within the time frame required. To account for this condition, a 50 percent failure rate will be applied for the breaker to reset. It is believed to be highly likely that if the breaker would reset, that operations could close 1-MS-4025 prior to reaching 800 psia in the steam generators. An estimated failure likelihood of 10 percent is assumed for this action. With the MSIVs closed, main feedwater would not be available to feed the steam generators and the turbine bypass valves would not be available to remove decay heat. Given the time frame applicable, the overall 60 percent failure to isolate probability, and the results of this failure, there was an approximate $4.1E-06$ increase in core damage frequency. This analysis was performed using Revision A of the Calvert Cliffs Nuclear Power Plant Probabilistic Risk Assessment plant model and Revision 0 for Initiating Event Frequencies.

This event is reportable in accordance with 10 CFR 50.73(a)(2)(iv), Any event or condition that resulted in a manual or automatic actuation of any engineered safety feature including the Reactor Protective System.

IV. CORRECTIVE ACTIONS

- A. The suspected logic module in SGIS "A" was replaced and tested satisfactorily.
- B. The suspected logic module was sent to the vendor for testing and destructive analysis.
- C. The motor operator for 1-MS-4025 was repaired. Excess electrical lead-length was removed, edge softeners were added to wiring penetrations, and the motor operator and field cabling was rewired.
- D. The wiring for the motor operator for 1-MS-4026, the second-stage steam source isolation valve for No. 12 Moisture Separator Reheater, was inspected and found in satisfactory condition.
- E. A formal root-cause assessment is in progress to determine underlying causal factors, evaluate generic implications, and establish additional corrective actions as required.

V. ADDITIONAL INFORMATION

A. Component Identification

Component	IEEE 803 EIIIS Function	IEEE 805 System ID
SGIS Module	IMOD	JE

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B. Previous Similar Events

No other events of this type have occurred at Calvert Cliffs Nuclear Power Plant.